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BY

ARTHUR WILLEY
Of the Department of Zoology, McGill University, Montreal, Canada

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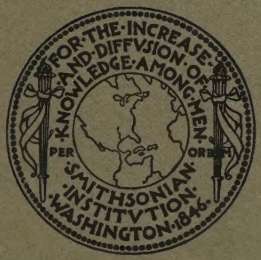

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DESCRIPTION OF A NEW SPECIES OF FRESH-WATER COPEPOD OF THE GENUS MORARIA FROM CANADA

By Arthur Willey

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Last year the writer briefly recorded the finding of an undescribed species of *Moraria*, a genus of harpacticoid copepods new to the American continent, in a Laurentian mountain spring. This was early in August, 1925. Those obtained on that occasion were all immature. On revisiting the spot, near the station of Weir, Province of Quebec, a month later, hoping to find more fully developed individuals, the spring had run dry. This year, in the month of July, there was again no water there, but fortunately in other localities I have found the same species in the mature state, namely, near Shawbridge and at three stations off the Arundel road. One of the sources for the material was not a spring but a sphagnum bog in which pitcher plants were growing very luxuriantly beside a mud lake near Macdonald Lake.

Giesbrecht (1892, p. 768) drew attention to the fact that the calanoid fauna of the warmer parts of the ocean exhibits a greater degree of specific divergence than in the North Atlantic. The reverse is true of fresh-water copepods, especially the harpacticoids, where the number of species increases from south to north, a fact which not only suggests a northern origin for these forms but also points to their Pleistocene derivation. In other words, the northern fresh-water harpacticoids, as an ecologic group, are relict forms of the postglacial fauna. A double interest is attached to them on this account. There is another point that requires repeated confirmation. It was tentatively assumed by the writer that the North American fresh-water harpacticoids differ, to the extent of certain unit characters, from their nearest representatives in the Old World. The present species seems to bear out that interpretation.

The genus *Moraria*, named after Loch Morar in Argyllshire, Scotland, was established in March, 1893, by T. and A. Scott. It supersedes the name *Ophiocamptus* introduced by Mrazek in May of the same year. Two of the principal species that have been described

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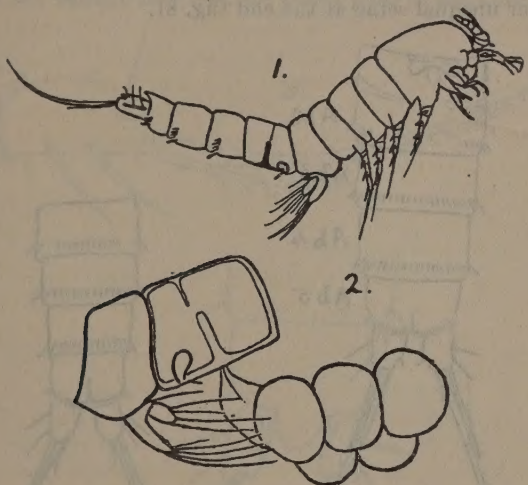
are *M. brevipes* (G. O. Sars, 1862, syn. *Ophiocamptus sarsi* Mrazek) and *M. schmeili* Douwe, 1903. The European range of the former extends into southern Norway, the latter was found in the upper Bavarian moorlands. The species now to be described from the Laurentian hills is closely related to *M. schmeili*, differing from it chiefly in small but definite characters affecting the first pair of legs, the abdominal spinules, and the caudal stylets or furcal rami.

There are three stages, having approximately the same length of body, which require to be distinguished, namely, the junior stage before external sexual differentiation has set in, the submature stage after this event but before maturity, and the adult stage. The junior stage, which will be described, differs markedly from the adult and recapitulates some features which the latter has lost. The submature stage is characterized by a deep constriction of the last joint of the anterior antennae making them appear to be eight-jointed, and by the shortness of the setae on the fifth pair of legs. These setae are very long in the adult, offering a striking contrast to their condition in *M. brevipes*.

There is some confusion regarding the naming of the species in this genus. C. van Douwe (1909) records three species found in Germany: *M. sarsi* Mrazek, *M. muscicola* Richters, and *M. schmeili* Douwe. G. O. Sars (1907) describes one species in the fauna of Norway: *M. brevipes*, synonymous with *M. anderson-smithi* Scott 1893, and with *Ophiocamptus sarsi* Mrazek 1893. In 1895, T. Scott described, under the name *Ophiocamptus brevipes*, another species, closely similar to one which had previously been recorded from Bohemia under the same name by Mrazek (1893). Sars (1907, p. 207) remarks that the species named *O. brevipes* by Mrazek, is specifically distinct, and he refers to it as *Moraria mrazeki* Scott, but I have not found this name employed elsewhere. It seems incumbent upon one to accept the latter name for the species described as *O. brevipes* by Mrazek, whereas that named *O. brevipes* by Scott must receive a new name, *Moraria scotti*, since it appears to differ from *M. mrazeki* to the same extent as that species differs from *M. schmeili*. There is still another Bohemian species, *Moraria poppei* (Mrazek), with crenulated posterior margins of the segments, which has also been found in Scotland by T. Scott (1897), but this is quite distinct and need not be discussed here.

Female.—The body is slender, of fairly even diameter, 0.44 mm. long, the segments separated by distinct intersegmental constrictions and their hinder edges smooth. In side view the genital segment is conspicuously subdivided by a refringent chitinous band which does not reach the dorsal surface. The ovisac is one-quarter the total length of the body and may contain five or six eggs only (figs. 1 and 2). The spermatophore (not shown in the figures) is narrowly ellip-

tical and nearly one-half the length of the ovisac. The abdominal segments or segments of the urosome are five in number (*Ab1* to *Ab5*). In the female, *Ab1* and *Ab2* have coalesced to form the composite genital segment; in the male they are separate. With this reservation, the same symbols can be employed for both sexes. The segments are smooth dorsally but carry rows of spinules laterally and ventrally near the hinder borders. The distribution of the ventral spinules offers specific characters.



FIGS. 1-2.—MORARIA LAURENTICA. 1, FEMALE IN SIDE VIEW. 2, THE LAST TRUNK SEGMENT AND GENITAL SEGMENT SHOWING THE FIFTH FOOT AND THE OVISAC

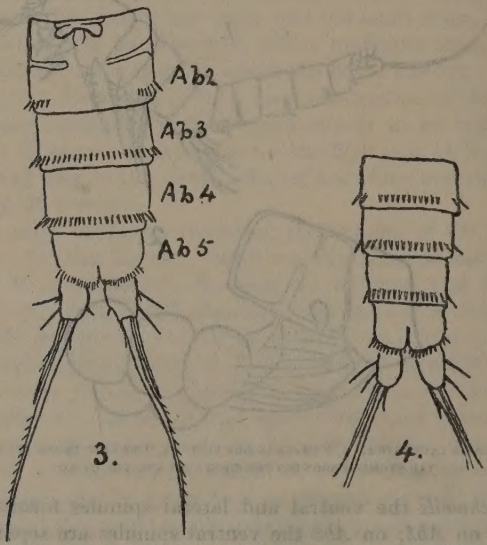
In *M. schmeili* the ventral and lateral spinules form together a single row on *Ab4;* on *Ab3* the ventral spinules are separated from the lateral by an interval on each side. In *M. laurentica* the ventrolateral rows of spinules are complete on *Ab4* and on *Ab3* in both sexes. On *Ab2* there are no ventral spinules in the female, the lateral groups being separated by a wide gap (fig. 3); but in the male there is a complete row of spinules on this segment in *M. schmeili*, whereas in *M. laurentica* the ventral spinules in the male are separated on each side by an interval from the lateral spinules (fig. 4).

The furca offers one of the most distinctive characters by the presence in both sexes of a very conspicuous dorsal crest which runs somewhat obliquely along the upper side of each ramus and ends in a projecting point below which the dorsal seta is inserted (fig. 5). In the male the inner border of the furca is convexly expanded and smooth. In the female there is a transverse row of four spinules distad of the middle of the inner border. A similar difference exists between the sexes in *M. schmeili.*

The anal operculum is typically roundly produced and its edge is smooth (fig. 6).

The anterior antennae are 7-jointed, with a thick club-shaped olfactory seta of the fourth joint slightly exceeding the end of the antenna when stretched alongside the distal part of it. Between the antennae is the rostral plate showing concentric markings and bearing a small process at the end with two minute sense-hairs (fig. 7).

The outer branch of the posterior antennae is uniarticulate and carries four unequal setae at the end (fig. 8).



FIGS 3-4.—MORARIA LAURENTICA. 3, UROSOME OF FEMALE FROM BELOW. 4, UROSOME OF MALE FROM BELOW

The mandibular palp is biarticulate and the basal part is recumbent, a feature noted by C. van Douwe in *M. schmeili* and also figured by T. Scott (1895, pl. 10, fig. 4). The two setae flanking the distal joint were not made out in all preparations examined, but were seen distinctly in the one figured (fig. 9).

Maxilla: The distal lobe carries a strong seta plumose at the end (fig. 10).

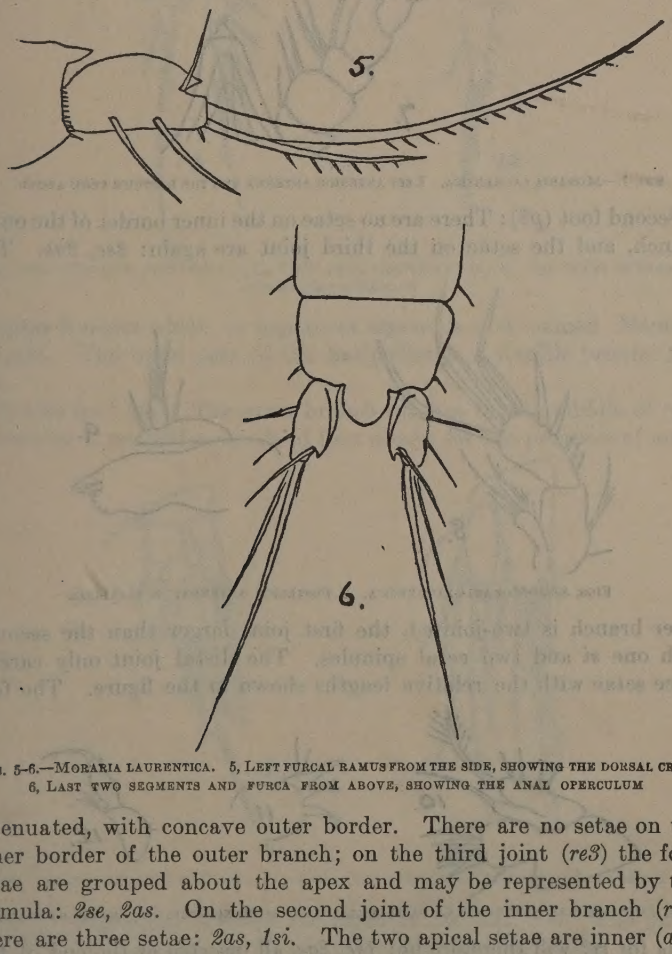
First maxilliped: With three digitiform, pointed lobes (fig. 11).

Second maxilliped: With very slender, terminal claw, and two setulae, a proximal and a distal, on the outer border of the middle joint (fig. 12).

Swimming feet (*p1* to *p5*): The following abbreviations may be used: *ri* and *re* are the inner and outer branches; *si* and *se* are the

setae on the inner and outer borders; *as*, the apical setae. The symbol *sa* is preoccupied by Giesbrecht to signify "anterior setae," while his symbol *st* for the terminal seta is not applicable to Harpacticidae.

First foot: Essentially alike in both sexes, the two-jointed inner branch is shorter than the outer, and the outer border of the distal joint is straight (fig. 13). In *M. schmeili* the inner and outer branches are equally long and the distal joint of the inner branch is



FIGS. 5-6.—MORARIA LAURENTICA. 5, LEFT FURCAL RAMUS FROM THE SIDE, SHOWING THE DORSAL CREST. 6, LAST TWO SEGMENTS AND FURCA FROM ABOVE, SHOWING THE ANAL OPERCULUM

attenuated, with concave outer border. There are no setae on the inner border of the outer branch; on the third joint (*re3*) the four setae are grouped about the apex and may be represented by the formula: *2se, 2as*. On the second joint of the inner branch (*ri2*) there are three setae: *2as, 1si*. The two apical setae are inner (*asi*) and outer (*ase*). The single *si* has a central insertion and is nearly as long as the *ase*, these two setae are subequal. In *M. schmeili* the

si is short and, in addition, there is a proximal spinule at the base of it which is not present in *M. laurentica*.

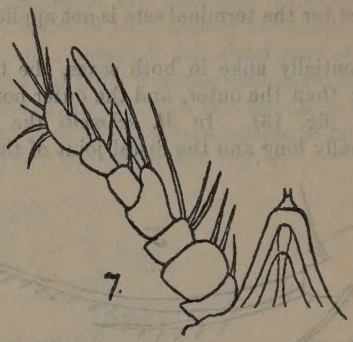
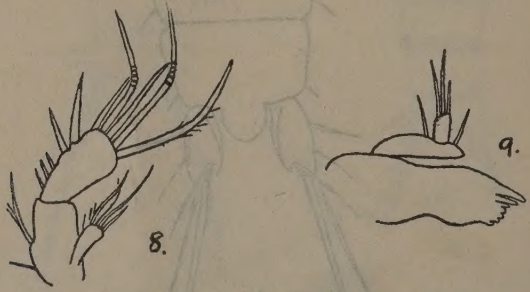


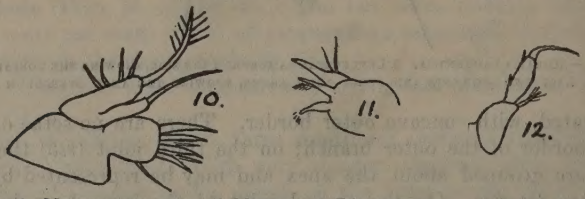
FIG. 7.—MORARIA LAURENTICA. LEFT ANTERIOR ANTENNA AND THE ROSTRUM FROM ABOVE

Second foot (*p2*): There are no setae on the inner border of the outer branch, and the setae on the third joint are again: *2se, 2as*. The



FIGS. 8-9.—MORARIA LAURENTICA. 8, POSTERIOR ANTENNA. 9, MANDIBLE

inner branch is two-jointed, the first joint larger than the second, with one *si* and two ectal spinules. The distal joint only carries three setae with the relative lengths shown in the figure. The for-



FIGS. 10-12.—MORARIA LAURENTICA. 10, MAXILLA. 11, FIRST MAXILLIPED. 12, SECOND MAXILLIPED

mula for *ri2* will therefore be: *1se, 2as*, all inserted at the end of the joint (fig. 14). The outer seta of the basipodite is a spine as it is in the first foot and as figured by Sars for his *M. brevipes*.

Third foot (*p3*): The setae of the outer branch are like those of the preceding foot. The inner branch is equal to the first two joints of the outer and its two joints are nearly equal in length. The formula for *ri2* is *1se, 2as, 1si*. This is like that figured by Mrazek for his *Ophio-*

FIGS. 13-14.—MORARIA LAURENTICA. 13, FIRST FOOT, ANTERIOR SURFACE. 14, INNER BRANCH OF SECOND FOOT OF FEMALE

camptus brevipes which, as explained above, is now named *Moraria mrazeki*. The outer seta of the basipodite is a flexible bristle (fig. 15).

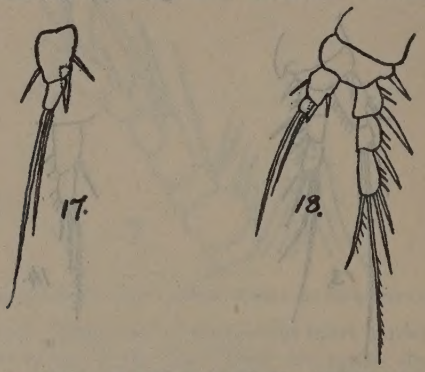
Fourth foot (*p4*): The inner branch reaches to the middle of *re2*. Otherwise it resembles the third foot except for the presence of an *si*

FIGS. 15-16.—MORARIA LAURENTICA. 15, THIRD FOOT OF FEMALE. 16, FIFTH FOOT OF FEMALE

on *re3*. Hence the formula for *p4re3* is *2se, 2as, 1si*. The outer bristle of the basipodite is again a rather long slender seta.

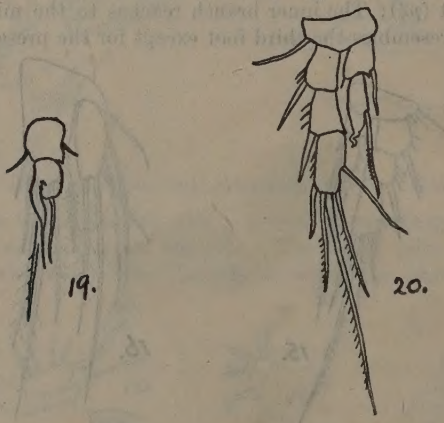
Fifth foot (*p5*): This is very similar to the corresponding appendage in *M. schmeili*, having the same two strong spinules between the

bases of the marginal setae of the inner expansion. There is one difference which seems to be definite. In *M. laurentica* the inner border of the distal segment of the appendage is chitinously thickened and quite smooth (fig. 16). In *M. schmeili* this border is ciliated.



FIGS. 17-18.—MORARIA LAURENTICA. 17, INNER BRANCH OF SECOND FOOT OF MALE. 18, SECOND FOOT OF ANOTHER MALE

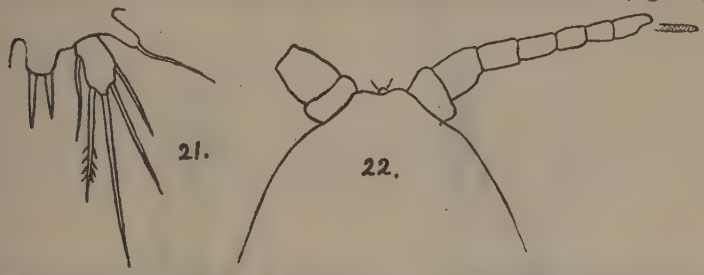
Male.—The male has a length of 0.42 mm. The inner branch of the second foot is modified in the following manner. On the proximal joint there is an *se* and an *si* nearly opposite to each other and,



FIGS. 19-20.—MORARIA LAURENTICA. 19, INNER BRANCH OF THIRD FOOT OF MALE. 20, FOURTH FOOT OF MALE

in addition, another *se* in the form of a strong spine at the distal angle (fig. 17). The distal, porrect, ectal spine is refringent and outshines the small distal joint, but in a camera drawing of the whole foot it is partly hidden by the distal joint (fig.18).

Characteristic of the inner branch of the third foot is the long sword-shaped inner apical seta, sparsely ciliated along its inner distal border which projects beyond the apex of the mucroniform process. The first joint has an outer seta as well as the inner one (fig. 19).

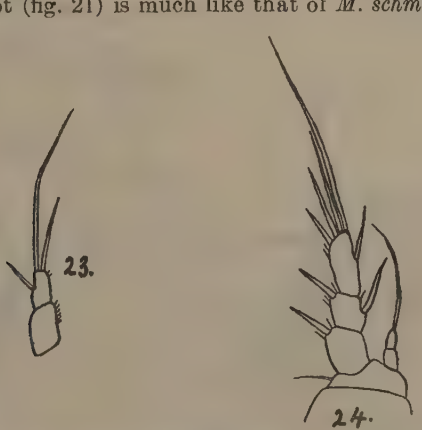


FIGS. 21-22.—MORARIA LAURENTICA. 21, FIFTH FOOT OF MALE. 22, OUTLINE OF HEAD OF JUNIOR FROM ABOVE. ON THE RIGHT THE APICAL PORTION ONLY OF THE OLFACTORY CLUB OF THE FOURTH JOINT IS SEEN PROJECTING BEYOND THE END OF THE ANTENNA

It is a generic character of *Moraria* that the inner branch of the third foot is biarticulate.

In the fourth foot it is difficult to decipher the somewhat vague extremity of the inner branch, but the long inner seta of the second joint, roughened on its outer side, is typical of the species (fig. 20).

The fifth foot (fig. 21) is much like that of *M. schmeili*.



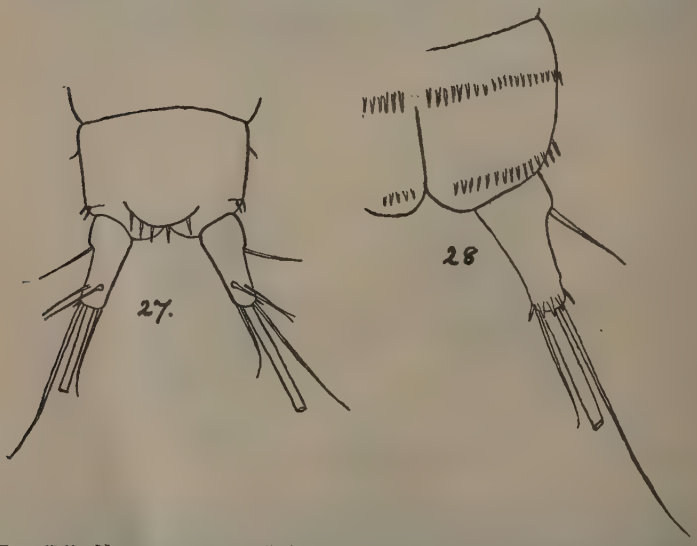
FIGS. 23-24.—MORARIA LAURENTICA. 23, INNER BRANCH OF FIRST FOOT OF JUNIOR. 24, SECOND FOOT OF JUNIOR

Junior.—By "junior" is intended here the stage before the last exuviation. It is a very slender, straight form not appearing obviously young at first sight except that, as indicated at the beginning of this paper, there were no recognizable males and no egg-bearing females. It attains practically the same length as the adult. One individual was found in process of ecdysis. This circumstance,

coupled with the general agreement in point of size, together with the fact that all the other Morariae, subsequently found in different

FIGS. 25-26.—MORARIA LAURENTICA. 25, THIRD FOOT OF JUNIOR. 26, FOURTH FOOT OF JUNIOR

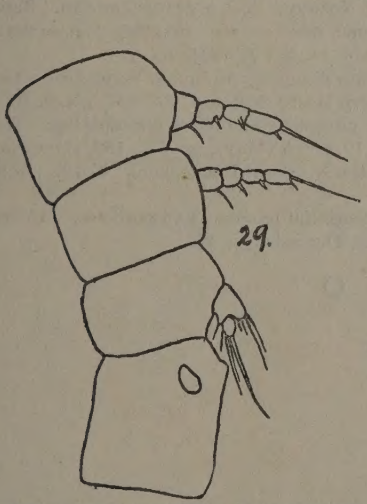
localities, belong to one species, seemed to be decisive in identifying the juniors with the adults specifically. The smallest one seen

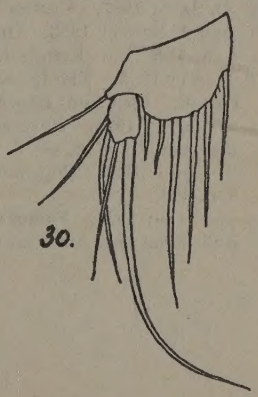


FIGS. 27-28.—MORARIA LAURENTICA. 27, ANAL SEGMENT AND FURCA OF JUNIOR FROM ABOVE, SHOWING SPINULES AT EDGE OF ANAL OPERCULUM. 28, ANAL SEGMENT AND FURCAL RAMUS OF JUNIOR FROM BELOW

had a length of 0.34 mm. This is below the range of variation of the adult.

The chief distinguishing characteristics of the junior stage are the length of the sensory club of the fourth joint of the anterior antennae, exceeding the end (fig. 22); the absence of an *si* on the proximal joint of the inner branch of the first foot (fig. 23); the small size of the inner branches of the second and third feet (figs. 24 and 25); the uniarticulate inner branch of the fourth foot (fig. 26); the presence of a varying number, from three to five, of spinules at the edge of the anal operculum (fig. 27); and the absence of crests on the caudal stylets (figs. 27 and 28). Another very striking feature is afforded by the presence of setae on the inner sides of the outer branches of the second, third, and fourth pairs of swimming feet. These inner setae, so characteristic of *Canthocamptus*, are thus discarded at the





FIGS. 29–30.—MORARIA LAURENTICA. 29, LAST THREE SEGMENTS OF TRUNK SHOWING SHORT SWIMMING FEET AND FIFTH FOOT, AND THE GENITAL SEGMENT UNDIVIDED. 30, FIFTH FOOT OF JUNIOR

final metamorphosis, with the exception of that on the third joint of the fourth foot (*p4re3si*). The inner branches of the feet exhibit a retarded development, the outer branches a precocious differentiation. The fifth foot (figs. 29 and 30) lacks the innermost seta of the small distal joint.

The types of this species consist of a male and an ovigerous female with an attached spermatophore. They bear the numbers 59850 (female holotype) and 59851 (male paratype) in the United States National Museum. At the same time it is the type of the genus *Moraria* on the American continent.

The immature stages of fresh-water harpacticoids have been very imperfectly studied and in this instance the junior presents some sharply defined features of unexpected significance.

By way of comparison, it may be noted that in the junior of *Attheyella frigida* the setae on the swimming feet are numerically the same as in the adult but they exhibit a marked substantive difference in that the inner setae are uniformly short and subequal.

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